

CLAIMS

We claim:

1. A device for measuring properties associated with aerated particles, comprising:
 - an outer container adapted to contain a fluid;
 - an inner container positioned in the outer container and having at least one inlet for admitting a gas and at least one outlet for releasing the gas; and
 - at least one load application device passing through an outside wall of the outer container and forming an end of the inner container;wherein the fluid contained in the outer container is usable to determine changes in volume of aerated particles contained in the inner container.
2. The device of claim 1, wherein the inner container is formed from a membrane.
3. The device of claim 1, wherein the inner container is formed from latex.
4. The device of claim 1, further comprising at least one inlet filter for diffusing fluids entering the inner container and at least one outlet filter for substantially limiting particulate materials from being passed from the inner chamber.

5. The device of claim 1, further comprising at least one inlet coupled to a bottom portion of the inner container and at least one outlet coupled to a top portion of the inner container.

6. The device of claim 1, further comprising an environmental chamber in fluid communication with the inner container for controlling environmental parameters selected from the group consisting of humidity and temperature.

7. The device of claim 6, wherein the environment chamber is selected from the group consisting of an oven and a refrigeration system.

8. The device of claim 1, further comprising at least one blower in fluid communication with the at least one inner container.

9. The device of claim 1, further comprising a computer for recording data the device.

10. The device of claim 1, wherein the load application device is a piston formed from a head coupled to a shaft extending through the outer container.

11. The device of claim 1, further comprising at least one pressure sensing device coupled to the inner container.

12. The device of claim 1, further comprising a flowmeter for determining the rate of flow of air through the inner container, a thermometer for determining the temperature of the air flowing through the inner container, and a volume change sensor for determining the change in volume of the aerated particulate material in the inner chamber when a load is applied to the material.

13. A system for measuring properties associated with aerated particles, comprising:

a chamber for containing a particulate material, comprising:

an outer container for containing a fluid;

an inner container positioned in the outer container and having at least one inlet and at least one outlet; and

at least one load application device passing through an outside wall of the outer container and forming an end of the inner container;

a volumetric change sensor for determining change in volume of the inner container by determining a change in level of the fluid in the outer container; and

an storage device for storing parameters quantified using the chamber.

14. The system of claim 13, wherein the inner container is formed from a membrane.

15. The system of claim 13, wherein the inner container is formed from latex.

16. The system of claim 13, further comprising at least one inlet filter for diffusing fluids entering the inner container and at least one outlet filter for substantially limiting particulate materials from being passed from the inner chamber.

17. The system of claim 13, further comprising at least one inlet coupled to a bottom portion of the inner container and at least one outlet coupled to a top portion of the inner container.

18. The system of claim 13, further comprising an environmental chamber in fluid communication with the inner container for controlling environmental parameters selected from the group consisting of an oven and a refrigeration system..

19. The system of claim 18, wherein the environment chamber is adapted to control parameters selected from the group consisting of humidity and temperature.

20. The system of claim 13, wherein the storage device is a computer.

21. The system of claim 13, wherein the load application device is a piston formed from a head coupled to a shaft extending through the outer container.

22. The system of claim 13, further comprising at least one pressure sensing device coupled to the inner container.

23. The device of claim 13, further comprising a flowmeter for determining the rate of flow of air through the inner container, a thermometer for determining the temperature of the air flowing through the inner container, and a volume change sensor for determining the change in volume of the aerated particulate material in the inner chamber when a load is applied to the material.

24. A method for measuring properties associated with aerated particles, comprising:

placing a sample of particulate material in a particulate measuring device, the particulate measuring device, comprising:

an outer container for containing a fluid;

an inner container containing the sample of particulate material, positioned in the outer container, and having at least one inlet and at least one outlet; and

at least one load application device passing through an outside wall of the outer container and forming an end of the inner container;

wherein the fluid contained in the outer container is usable to determine changes in volume of aerated particles contained in the inner container.

filling the outer container with a fluid;

aerating the particulate material by supplying air to the particulate material through the at least one inlet;

applying a load to the particulate material using the at least one load application device; and

determining the amount of load applied to the particulate material.

25. The method of claim 24, further comprising passing the air through at least one environmental chamber for controlling environmental parameters selected from the group consisting of humidity and temperature.

26. The method of claim 24, wherein determining the amount of load applied to the particulate material comprises using a storage device to record readings produced by devices selected from the group consisting of a pressure gauge, a thermometer, a flowmeter, and a volumetric sensor.

27. The method of claim 24, further comprising measuring the rate of gas flow through the particulate material contained in the inner container to determine the degree of aeration of the particulate material and whether the particulate material has reached a fluidized state.

28. The method of claim 24, further comprising measuring the pressure differential between the inlet and the outlet of the inner container, measuring the pressure contained in the outer container, and measuring the volumetric change of the inner container as an axial load is applied to a particulate material by measuring a change in fluid level in the outer container.